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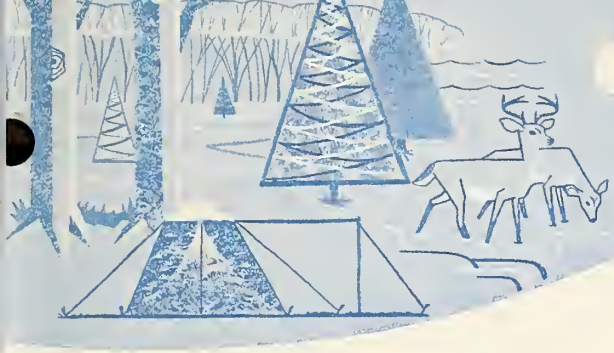

U. S. FOREST SERVICE

RESEARCH NOTE LS-7

LAKE STATES FOREST EXPERIMENT STATION • U. S. DEPARTMENT OF AGRICULTURE

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Natural Mortality of the Zimmerman Pine Moth in Three Michigan Plantations

The Zimmerman pine moth (*Dioryctria zimmermani* Grote) is an important pest of Scotch and red pine plantations in Michigan. Knowledge of population dynamics is essential before the most efficient control methods can be developed. In 1960 and 1961, data were collected on the degree and causes of natural mortality of larvae and pupae on one Scotch pine and two red pine plantations in Saginaw and Ottawa Counties, Mich.

In this area the insect has a 1-year life cycle, according to observations by Carlson[1] and the present author. The eggs are laid during August in bark crevices. The larvae hatch in late August and early September, then spin silken hibernacula under bark scales for overwintering. The next spring and summer, they feed in the cambium area, pupate in July and August, and transform to adults within 2 or 3 weeks after pupation. The tips and trunks of pine trees are damaged.

The plantations studied were spaced at 6x6 feet and were 8 years old with trees varying from 5 to 8 feet tall when the observations started. In the early summer of 1960 the shoots and trunks of a group of trees were carefully examined for pitch masses characteristic of Zimmerman pine moth attack.[2] One hundred pitch masses on shoots and 100 on trunks were tagged. They were examined three times during that growing season, and the insects were recorded as living, dead, or missing. At each examination, those pitch masses which did not show fresh pitch or frass were opened. All parasites were collected and reared for identification. The same procedures were followed during the 1961 observations.

Survival was low during the summers of 1960 and 1961 (fig. 1). There were about two active infestation sites per tree in June, whereas in late August there were less than 0.25 per tree — a drop of nearly 90 percent. However, these decreases appeared to have little effect on the population trend because initial 1961 infestations were hardly lower than initial 1960 infestations. Overall mortality of an insect population amounting to 90 percent is not unusual and may even permit an increasing population trend in subsequent generations because of the large reproductive potential of most insects. For the Zimmerman pine moth in the study plantations, 90 percent mortality during the segment of the life cycle studied appears to be near the point of static equilibrium — resulting in unchanged population levels in subsequent generations.

At the low-to-moderate infestation levels in these plantations, no more than one insect usually occurred per pitch mass. In heavy infestations, more than one insect per pitch mass is common.

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[1] *Carlson, R. B. The life history and biology of Dioryctria zimmermani Grote (Lepidoptera, Phycitidae) in southern Michigan. M. S. Thesis, 37 pp., Mich. State Univ., East Lansing, Mich.*

[2] *Three other species of pine moths in Michigan might be confused with the Zimmerman pine moth. A method of differentiating the damage of these pests is given in Lake States Technical Note 571.*

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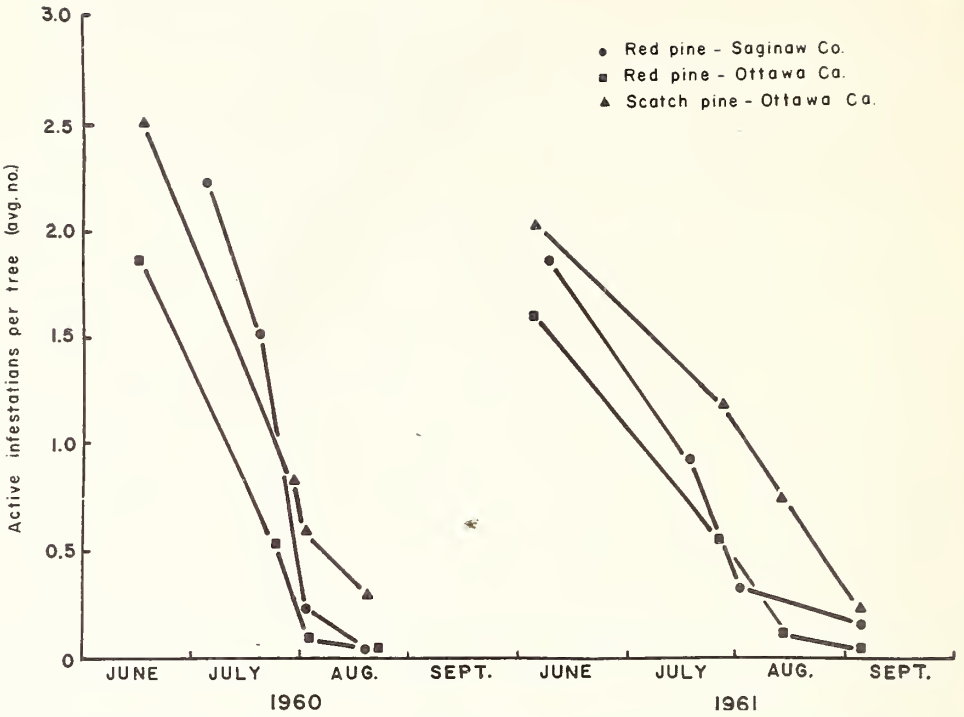

FIGURE 1. — Natural decline of the Zimmerman pine moth in three pine plantations during 1960 and 1961.

The mortality of known causes was due to parasitization. The eulophid wasp *Hyssopus rhyacioniae* (Gah.) destroyed 6 to 14 percent of the larvae in 1960 and 15 to 33 percent in 1961. A tachinid fly, tentatively identified as *Lixophaga* sp., accounted for 2 to 4 percent parasitism in 1960 and 3 to 6 percent in 1961. No diseased larvae were noted.

The large remaining proportion of the decline was due to unknown causes, the larvae and pupae simply disappearing unaccountably. In future studies on the population dynamics of the Zimmerman pine moth, the causes of this extensive presumed mortality should be investigated.

ROBERT L. TALERICO[3]
Entomologist
(Plant Pests)

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[3] *Data for this study were collected while the author was on the staff of the Lake States Forest Experiment Station. He is now a member of the Forest Pest Control Branch of the Northeastern Region, U.S. Forest Service.*